

R E M A R K S

This is in response to the Office Action that was mailed on July 8, 2004. The preamble of claim 23 is amended to recite the disclosed improved thermal stability which characterizes the compositions claimed, based e.g. upon such disclosure as that appearing in the paragraph bridging pages 52-53 of the specification. No new matter is introduced by this amendment. Inasmuch as this Amendment expresses an inherent characteristic of the claimed compositions, entry of this Amendment – in order to place the application into condition for allowance or into better condition for appeal – is respectfully solicited. Claims 23, 24, 29, 30, 34, 39, 40, 50-52, 65, 67-69, and 73 are pending in this application.

With respect to withdrawn claims 50-52, 65, and 69, it is respectfully urged that all of the claims remaining in this application can and should be examined together in this application. It is noted in this regard that claim 73 is a linking claim. The Examiner is respectfully requested to modify the restriction requirement accordingly.

THE SODIUM CARBOXYMETHYLCELLULOSE BINDER INVENTION

Claims 67-69 and 73 relate to compositional invention embodiments characterized by the presence of a sodium carboxymethyl-cellulose binder (the SODIUM CARBOXYMETHYLCELLULOSE BINDER INVENTION). The recited sodium carboxymethylcellulose binder feature of this embodiment of the present invention provides the claimed compositions with unexpected improvement with respect to reduction in carbon monoxide generation.

Claims 67, 68, and 73 were rejected under 35 U.S.C. §103(a) as being unpatentable over Barnes or Mendenhall, each in view of Lund, and further in view of US 5,780,767 (Matsuda), US 6,468,369 (Zhou), or US 5,834,679

(Seeger). The Examiner admits that Barnes and Mendenhall fail to disclose or suggest the sodium carboxymethylcellulose component of the presently claimed compositions, but argues that Matsuda, Zhou, and Seeger are suggestive of substituting sodium carboxymethylcellulose for the guar gum of the primary references. The Lund reference is totally irrelevant to the rejections of claims 67 and 68, and is at best tangentially relevant to the rejection of claim 73.

MATSUDA. The primary references indicate that gas generating compositions should be non-toxic. See e.g. Barnes, column 1, lines 13-25. Matsuda, on the other hand, shows an azide compound or an organic compound such as a dicyandiamide as a fuel. The use of azide compounds as in Matsuda is directly contrary to the teaching of the primary references regarding non-toxicity. Therefore the combination of Matsuda with Barnes or Mendenhall is improper. Also, dicyandiamide is reactive with BCN, so that the use of such compounds is impossible in gas generating compositions. In any case, the GN/BCN/CMCNa composition of the present invention is unexpectedly superior to the compositions of Examples 18 and 19 of Matsuda.

ZHOU. The Zhou reference shows a phase stabilized ammonium nitrate having a very low melting point. If this compound is used in a gas generating composition, combustion must be effected at a high pressure. For this reason, it is not proper to combine Zhou with Barnes or Mendenhall. The combustion disclosed by the primary references will not be obtained with the suggested combination of Barnes or Mendenhall with Zhou. Applicants note that compositions of the present invention can have a pressure exponent of 0.32, whereas the Zhou compositions have a pressure exponent of 0.42 to 0.85. The correlation between burning rate and burning pressure is $r = a \times P^n$, in which "n" is a pressure exponent (pressure index) and "a" is a constant depending on the kind of gas generating agent. In gas generating agents having a small value of "n", the burning rate does not change greatly even with small changes in the pressure P. Gas generating agents having large "n" values change greatly in

burning rate, depending on pressure changes during combustion and changes in the inner pressure of the inflator caused by ambient temperatures. It is difficult to obtain good gas generating agents having high burning rates. In other words, the larger the pressure exponent is, the more difficult it is to control the combustion property, and unexpected deployment of air bags caused by excess pressure output may injure people. Finally, it is noted that the burning rates of the present invention (e.g., approximately 10 mm/s at 70 kg/cm², are superior to Examples 1-4 of Zhou, which have burning rates of less than 5 mm/s at 70 kg/cm²) because low burning rate compositions cannot be burnt within the 20-40 ms time frame needed for good inflator performance.

Applicants present the following tabular summary relating to the combination of Matsuda or Zhou with Barnes:

Present invention	(a) specified fuel	(b) BCN	(c) CMCNa
Barnes	guanidine nitrate	BCN	guar gum
Matsuda	Completely different gas generating agent		CMCNa
Zhou	Completely different gas generating agent		CMCNa

SEEGER. The Seeger reference shows an auto ignition material (AIM) composition, where the AIM composition is placed in a combustion chamber but separated from a gas generating agent, as shown in Seeger's Figures 2-5. The amount of the AIM composition is 60 to 150 mg and the composition contains about 1% to 50% (0.6 to 75 mg) of a binder. The auto ignition material is used in a small amount in a separate form from a gas generating agent. When a car with an air bag system that includes AIM is involved in a fire, the AIM will burn automatically before the housing is heated to the point where it loses strength and breaks up. If no AIM is included, the housing will be heated

by the fire to the point where it loses strength and the gas generating agent will then burn and break the weakened housing, potentially injuring passengers. Also, Seeger's compositions contain $\text{Pb}(\text{SCN})_2$ and will thus generate poisonous lead and cyanide gases.

The combinations of the Matsuda, Zhou, and Seeger references with the Barnes and Mendenhall references fail to suggest the unexpected improvement in properties (in particular, reduction in carbon monoxide emissions) provided by the present invention.

Even if the Examiner had established a *prima facie* case of obviousness with respect to the inventions of claims 67, 68, and 73 – which she has not – Applicants have presented the Declaration under 37 CFR 1.132 of Dr. Jianzhou WU. The Declaration of Dr. WU provides evidence of the unexpected superiority of the compositions of the present invention as compared to the properties of the compositions of the primary references. Specifically, the presently claimed compositions surprisingly generate significantly smaller amounts of noxious carbon monoxide gas than do the corresponding prior art compositions. Thus, Composition A, representative of the present invention, generated only 215 ppm CO, while Composition C, representative of Barnes, generated 440 ppm CO. Likewise, Composition B, representative of the present invention, generated only 220 ppm CO, while Composition D, representative of Barnes, generated 500 ppm CO. These results carry over to the total amounts of noxious gases resulting from ignition of the present gas generant composition as compared to the total amounts of noxious gases resulting from ignition of the prior art compositions. Thus, Composition A, representative of the present invention, generated only 364 ppm total noxious gases, while Composition C, representative of Barnes, generated 612 ppm total noxious gases, an increase of 68%. Likewise, Composition B, representative of the present invention, generated only 296.5 ppm total noxious gases, while Composition D, representative of Barnes, generated 575 ppm total noxious gases, an increase of

94%!

To put the test data reported in the Rule 132 Declaration into practical perspective, enclosed herewith are three background publications. D1 and D2 are papers that were presented at the "3rd International Symposium on Sophisticated Car Occupant Safety Systems" in Karlsruhe, Germany on 26 and 27 November 1996. D3 is a document establishing official performance and validation requirements for inflator assemblies used in airbag modules. D1, which has an English-language abstract, makes the point that due to the increasing number of airbags in use, there is a need for gas generators that meet environmental and health requirements. D2 shows a typical installation pattern for airbag inflators. See Figure 9 on page 16-14 of D2. As is clear from D3, even small amounts, in ppm, of noxious gases is significant. See Table 3.2.3.2.3.A and 3.2.3.2.3.B on page 14 of D3. According to Table 3.2.3.2.3.A, the recommended effluent apportionment is 1/4 for driver side inflators, where four kinds of airbags (driver side, passenger side, pretensioners, and knee bolsters) are installed in a car. In this condition, for the driver side inflator, the effluent gas limits for NH₃, CO, NO, and NO₂ are 9.75 ppm, 115 ppm, 188 ppm, and 1.25 ppm respectively. These values are calculated from a simple proportional allotment of, e.g., 75.0 ppm x 1/4 = 18.8 for NO, etc. Thus the difference in terms of amount of discharged noxious gases in the Rule 132 Declaration, between e.g. Comparison C and Invention A, is significant. For example, 25 ppm of improvement out of an 18.8 ppm threshold, which is calculated as indicated above from D3, is huge and important. Accordingly, even if the Examiner had established a *prima facie* case of obviousness in the present situation, that *prima facie* case of obviousness is rebutted by the 'Declaration under 37 CFR 1.132' of Dr. Jianzhou WU which was filed herein on April 2, 2004.

THE BASIC METAL NITRATE PARTICLE DIAMETER INVENTION

Claims 23, 24, 29, 30, 34, 39, 40, 50-52, 65, and 73 are drawn to a compositional invention embodiment that is characterized by the presence of basic metal nitrate having a particle diameter in the range of 0.5 to 40 μm (the BASIC METAL NITRATE PARTICLE DIAMETER INVENTION). The recited basic metal nitrate particle diameter feature of this embodiment of the present invention provides the claimed compositions with unexpected improvement with respect to rapidity of ignition. As demonstrated in the present specification, these compositions have excellent thermal stability. For instance, even after standing in a high temperature atmosphere for 10 or more years, they do not decompose. Specification, page 12, first full paragraph.

Claims 23, 24, 29, 30, 34, 39, 40, and 73 were rejected under 35 U.S.C. §103(a) as being unpatentable over US 5,608,183 (Barnes) in view of US 5,500,059 (Lund). The same claims were also rejected under 35 U.S.C. §103(a) as being unpatentable over US 5,841,065 (Mendenhall) in view of Lund. None of Barnes, Mendenhall, and Lund show optimization of the particle diameter of the basic metal nitrate. None of these references suggests that optimization of the particle diameter of the basic metal nitrate can improve heat resistance. Accordingly, the rejections over Barnes in view of Lund and Mendenhall in view of Lund are respectfully traversed.

Claim 23 herein requires, among other things, that the claimed compositions include a basic metal nitrate “having a particle diameter of 0.5 to 40 μm ”.

Barnes neither teaches nor suggests compositions that include a basic metal nitrate having a particle diameter of 0.5 to 40 μm . The Barnes patent (which is only 3 pages long, including its bibliographic page and its claims) provides no teachings at all concerning the form in which the basic metal nitrate should be used. Barnes is completely silent about improvement of heat resistance.

Likewise, Mendenhall fails to teach or suggest a composition which includes a basic metal nitrate having a particle diameter of 0.5 to 40 μm . Mendenhall teaches adding zeolite to adsorb ammonia generated by decomposition of a gas generating agent, so that the ammonia is prevented from causing further decomposition of the gas generating agent. Mendenhall fails to suggest that optimization of any property of the gas generating agent (such as particle size) could improve the stability of the gas generating agent. In Mendenhall, the gas generating agent is allowed to decompose and the generated ammonia is merely removed to prevent further decomposition. The Mendenhall patent (which is even shorter than the Barnes patent) provides no teachings at all concerning the form in which the basic metal nitrate should be used.

Recognizing the deficiencies of the Barnes and Mendenhall references, the Examiner has now cited the Lund reference, stating that "Lund et al teaches the use of an oxidizer of 8.7 micron particle size (see example 12)". Lund merely relates copper oxide diameter to combustion velocity. "It has been found that gas generant compositions prepared from pyrometallurgical grade cupric oxide produce faster burn rates compared to hydrometallurgical grade cupric oxide." Column 5, lines 19-26. Lund does refer to stability in lines 62-65 of column 6: "One of the important advantages of the anhydrous 5-AT gas generating compositions of the present invention, is that they are stable and combust to produce sufficient volumes of substantially nontoxic gas products". That disclosure of "stability" however does not indicate what kind of stability nor what is stabilized. Lund fails to indicate whether or not the stability is caused by an oxidizer having a specified particle range. The Examiner has not explained how the Lund disclosure motivates those of ordinary skill in the art to produce the Barnes or Mendenhall basic metal nitrates in a particle size of 8.7 microns. The fact that a person of ordinary skill in the art **could** change the

disclosure of a primary reference in a particular way does not mean that he or she is **motivated** to make that change. Applicants believe that particle size considerations and their relationship to combustion velocity differ when considering copper oxide on the one hand and basic copper nitrate on the other.

Claim 29 herein requires everything that is required by claim 23 and additionally requires at least one feature selected from (1) a weight loss ratio of the gas generating composition, when the gas generating composition is retained in a closed state at 90°C for 1,000 hours or at 110°C for 400 hours, of 2.0 % or less, (2) concentrations of trace gases contained in a gas generated by the combustion of the gas generating composition, as values measured in a 2,800-liter tank, of 400 ppm or less for CO, 40 ppm or less for NO, 8 ppm or less for NO₂ and 100 ppm or less for NH₃, and (3) a maximum internal pressure in a gas generator on the combustion of the gas generating composition of 7,840 to 22,500 kPa. The Examiner alleges that the weight loss ratio, concentration of trace gases, or maximum internal pressure are inherent properties of the Barnes and Mendenhall compositions. The Examiner is respectfully reminded that she must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristics **necessarily** flow from the teachings of the applied prior art. MPEP 2112.

All of claims 23, 24, 29, 30, 34, 39, 40, and 73 are rejected by the Examiner over combinations of references. Inasmuch as the Examiner's rejection relies upon inherency, it is in violation of the principles of *In re Shetty*, 556 F.2d 81, 195 USPQ 753 (CCPA 1977). *Shetty* stands for the proposition that a prior art-based rejection involving inherency may not rely on plural prior art patents in combination. The *Shetty* facts may be visualized as follows:

	Structure	Effect	Amount of A used
Shetty	A	Suppressed appetite	a to b
Brake	A	No disclosure about effect	No disclosure about amount used
Narayanan	A	No disclosure about effect	a to b

In this Table “A” refers to the compound of Shetty. The court refused to uphold the rejection of Shetty as being inherent in the teachings of Brake and Narayanan. MPEP 2112 supports this proposition that a single prior art document must show all of the components of an invention except for an inherent property in order for this sort of rejection to be proper.

It is respectfully submitted that the Examiner has failed to state a sustainable obviousness rejection with respect to any of claims 23, 24, 29, 30, 34, 39, 40, and 73.

For the reasons given above, it is respectfully submitted that each of the presently claimed inventions is patentable over the prior art applied by the Examiner. Accordingly, the Examiner is respectfully requested to pass this application to Issue.

Should there be any outstanding issues to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned by telephone at the number listed below.


Pursuant to 37 C.F.R. §§ 1.17 and 1.136(a), Applicant(s) respectfully petition(s) for a two (2) month extension of time for filing a reply in connection with the present application, and the required fee of \$430.00 is attached hereto.

Appl. No. 09/914,548

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Enclosed: D1, D2, and D3.